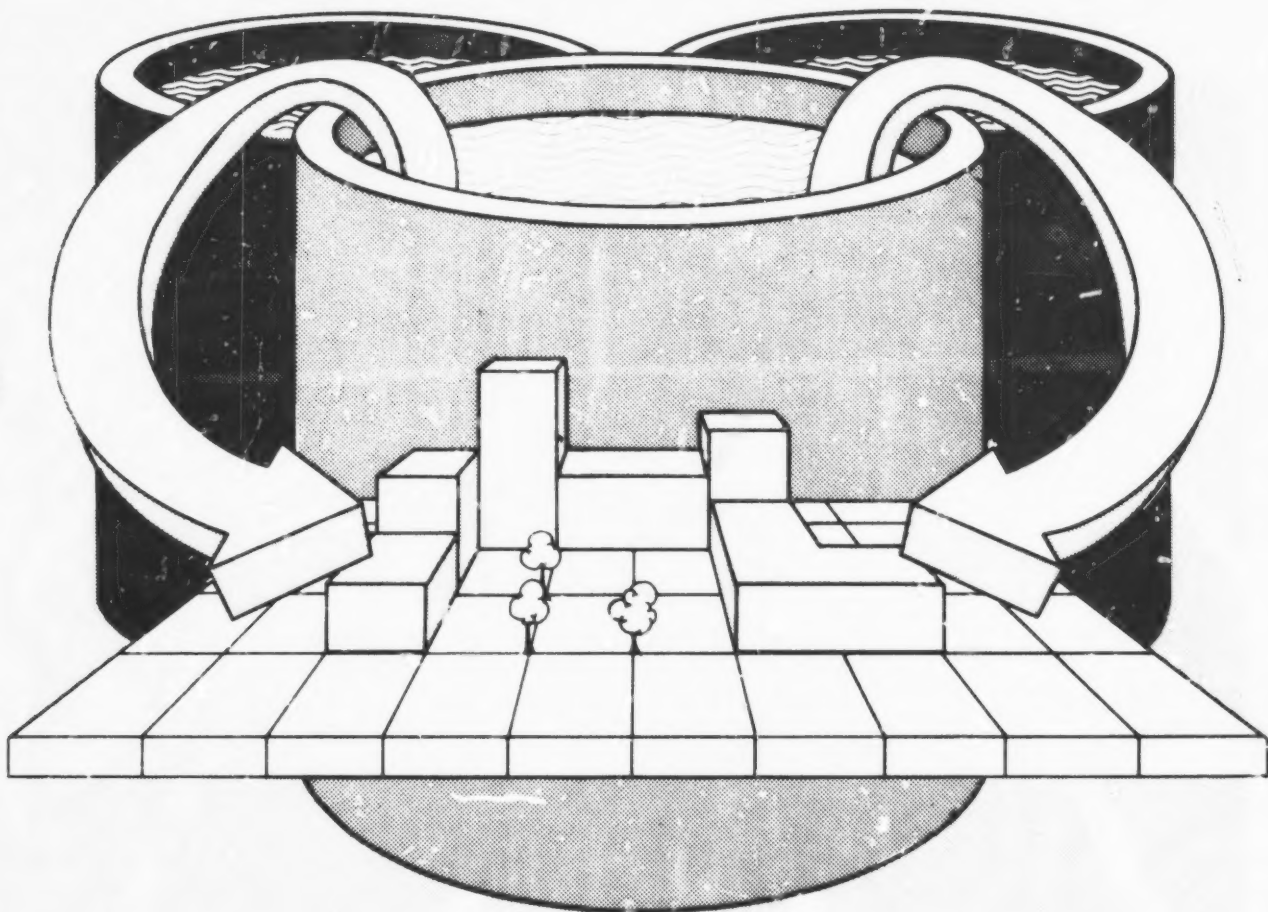


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FEDERAL EMERGENCY MANAGEMENT AGENCY

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Maintenance Manual Water Storage Devices & Pumps



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MAINTENANCE MANUAL

WATER STORAGE DEVICES & PUMPS

**Federal Emergency
Management Agency**

Introduction

The purpose of this manual is to guide you on how to maintain the essential components of your water storage system. The information in this manual is only a **supplement** to the recommended maintenance information supplied in the service manuals provided by the manufacturers of the equipment. **Always follow the maintenance procedures provided in the manufacturer's manuals.** This manual will help you understand why maintenance is necessary. This manual will also be helpful if the manufacturer maintenance manuals are not immediately available.

Description of Water Storage Devices & Pumps

A water storage system consists of tanks to store water and pumps to distribute it.

Storage tanks have a variety of purposes-- to help meet peak demands, to maintain even pressure throughout the water distribution system, and to supply the entire community with water in an emergency. These tanks are usually elevated and are made from steel or reinforced concrete. In addition EOC's often have their own water storage tanks, often underground, that can supply the EOC when normal supplies are disrupted.

Pumps distribute water from storage facilities to the community at large or are used to lift water from underground tanks to street level. Pumping stations are crucial components; often the mechanical equipment is duplicated, as a backup to the on-line system, to insure that interruptions will not occur. Booster stations are an additional element in the system, when water is distributed over great distances or to great heights.

Preventive Maintenance

To ensure that the components of your water storage system work in an emergency, you should develop a program where you **regularly check the devices to spot small troubles before they become big problems.** A program of coordinated monthly, annual and biennial maintenance checks prevent serious problems from suddenly happening.

Routinely clean all the units. Check for loose bolts and parts; lubricate and oil the pumps on a regular basis. Develop a habit of inspecting all equipment; integrate this inspection into other routines. These routines may not appear in manufacturer's manuals but are fundamental to any successful maintenance program.

Equipment and Spare Parts

Only ordinary mechanical and electrical tools are needed to perform most maintenance on this equipment.

Maintain a list of spare parts for each piece of equipment in your system. The following table gives you an example of such a list.

<u>Spare Parts. Water Storage Devices</u>	
<u>Name of part</u>	<u>Quantity</u>
grease	1 qt.
bearings	1 set
wear ring	2
gasket	2 sets
impeller	1

Safety

Water towers are usually elevated. Wear a safety belt or any other device to prevent a fall when inspecting the exterior of the tower.

Coatings for the interiors of steel tanks are usually toxic. Ventilate properly when applying these solvents and chemicals.

Follow safety precautions outlined in maintenance manuals supplied by the manufacturer when examining pumps. Contact an electrician if you encounter serious electrical problems with any pump.

Maintenance Checks: As Required for Pumps

1) Check pump for any irregularities during normal operation. Listen to the sound of the running pump and note any unusual noises. Check for abrupt changes in bearing temperatures and stuffing box leakage.

Monthly Maintenance Checks: Pumps

- 1) Check for free movement of stuffing box gland.
- 2) Clean and oil gland bolt nuts.
- 3) Check pump and driver alignment. Adjust as necessary.
- 4) Drain and refill oil lubricated bearings.
- 5) Examine grease lubricated bearings for correct amount and consistency of grease. Replace if necessary.

12-Month Maintenance Checks: Pumps

- 1) Remove, clean and examine bearings for flaws.
- 2) Clean bearing housing.
- 3) Replace packing.

12-Month Maintenance Checks: Pumps (cont.)

4) Examine shaft sleeves or shaft (if no sleeves used) for wear.

5) Examine alignment of vertical shaft movement. Any unusual movement requires an investigation to determine cause.

6) Check and flush all auxilliary piping such as drains, water-sealing/cooling water piping and auxilliary coolers.

7) Repack stuffing box.

8) Realign pump and driver.

9) Recalibrate all instruments and flow metering devices.

12-Month Maintenance Checks: Water Storage Tanks

1) Inspect anchor bolts for tightness and rust. Retighten and paint as necessary.

2) Inspect ladder and balcony for rust, missing bolts, etc. Repair as necessary.

3) Inspect user pipe for damage, leaks and condition of frost pipe.

4) Inspect tower for alignment of tower parts, foundation settlement, missing nuts or bolts, and condition of supporting rods.

5) Visually examine exterior tank coating for integrity.

6) Visually inspect interior tank coating for integrity. Touch up or repaint as necessary.

Corrective Maintenance: Troubleshooting

Some equipment malfunctions may be discovered during inspection of the pumps and tanks or in actual day-to-day use of your water distribution & storage system. Perform the tests on the following table to locate, and possibly correct, the problem.

PLEASE NOTE: This manual does not attempt to list all possible malfunctions that could occur nor can we suggest all possible remedies. Consult the manufacturer's manuals or the manufacturer directly if a malfunction is not listed or it is not corrected by a prescribed procedure.

Corrective Maintenance: Water Storage System (Part 1 of 5)

Malfunction	Possible Cause	Recommendation
1. Insufficient flow	■ pump speed too low, or reverse rotation	■ check driver speed and rotation
2. Capacity or insufficient discharge pressure	■ actual suction pressure lower and/or actual discharge higher than stated for design conditions ■ worn impeller ■ casing gasket objective permitting internal leakage ■ wearing rings worn	■ check whether all valves fully open. Check piping for trapped air pockets, especially at elbows or high points. Check pipe friction computation & elevation of heads from pump center-line to suction & discharge level. Check pressure in suction source. ■ check pumping fluid against that specified in design conditions. Replace impeller if necessary. ■ replace casing gasket ■ replace wearing rings

Corrective Maintenance: Water Storage System (Part 2 of 5)

Malfunction	Possible Cause	Recommendation
3. Excessive flow capacity or too high discharge pressure	■ pump speed too high ■ actual suction pressure higher and/or actual discharge lower than stated for design conditions	■ check speed of driver ■ throttle discharge valve, or install orifice in discharge piping, or provide bypass line with regulating valve for return of excess flow to suction source.
4. Excessive noise or vibration	■ check driver speed & rotation ■ pump operating under cavitation, i.e., evaporation of fluid at pump entry because NPSH requirement of pump is equal to or exceeds NPSH available in plant. To determine whether pump cavitates, throttle discharge valve slowly until noise and/or vibration diminishes.	■ check pumped fluid against that specified in design conditions ■ check valves in suction piping to see if fully open. Check suction for entrapped air pockets, especially in elbows & high points. Check suction well for vortex and, if necessary, provide baffles. Check pressure in closed suction tank. Check suction temperature as well as viscosity & vapor pressure of pumped fluid.

Corrective Maintenance: Water Storage System (Part 3 of 5)

Malfunction	Possible Cause	Recommendation
4. Excessive noise or vibration (cont.)	■ baseplate not properly grouted	■ check baseplate grouting for air pockets by sounding off baseplate with hammer
	■ misalignment of pump & driver	■ check shaft alignment with dial indicator
	■ pumped fluid contains solids creating shock load & clogging or damaged impeller	■ install strainer in suction piping. Backflush pump with clean fluid, or open pump to inspect & clean impeller.
	■ transient vibration from piping.	■ support & secure piping or provide compensators.
5. Excessive power consumption	■ pump speed too high	■ check driver speed
	■ specific gravity and/or viscosity of pumped fluid higher than stated for design	■ check pumped fluid against specifications in design
	■ stuffing box overtightened	■ loose gland nuts
6. The stuffing box leaks	■ worn, unsuitable or badly fitted packing	■ repack the stuffing box and use a suitable stuffing

Corrective Maintenance: Water Storage System (Part 4 of 5)

Malfunction	Possible Cause	Recommendation
6. The stuffing box leaks (cont.)	■ The shaft, resp. the shaft protecting sleeve, has wear grooves because the gland has been tightened too hard or askew	■ The shaft or shaft protecting sleeve must be ground smooth or replaced by a new one
	■ the pump runs rough, i.e., the shaft runs out of true	■ no stuffing box can remain leaktight if the shaft runs out of true, therefore the shaft must be checked for true running
7. Excessive bearing temperature	■ the set is misaligned	■ check alignment on the coupling
	■ the piping transmit stresses to the pump	■ modify the piping to obtain a stress-free connection to the pump. Re-align pumping set.
	■ excessive axial thrust; resulting excessive clearance at impeller neck	■ restore normal clearance by fitting a new wear ring; if necessary fit a new impeller
	■ resulting from plugging of the balance holes or excessive wear of the wear rings	■ clean the balance hole. Fit new wear rings.

Corrective Maintenance: Water Storage System (Part 5 of 5)

Malfunction	Possible Cause	Recommendation
7. Excessive bearing temperature (cont.)	■ axial clearance on coupling is insufficient (motor shaft slides)	■ restore required axial clearance on coupling
	■ insufficient lubricating oil, or deterioration of oil	■ top up oil, or if necessary renew oil fill
8. Freezing up of pump	■ pump not protected from cold weather	■ protect pump from cold. Failing this, drain pump completely every time it is stopped. To do this, remove drain plug at bottom of volute casing.